REMARKS:

I) Claim 1 has been amended to distinguish over Hartmann et al. in now reciting specific spacing between the electrolysis region and a contacting electrode (6, 14) and in now stating specific distance (length) of the electrolysis region. The indefinite language for which claims 1- 2 and 5- 23 stand rejected under 35 USC §112, second paragraph, has been deleted.

Claims 12 and 14 have also been amended to recite to eliminate the indefinite language for which they stand rejected under 35 USC §112, second paragraph, has been eliminated.

II) Claims 1-2, 5, 8, 9, 11, 12, 17-20 and 22- 23 stand rejected under 35 USC §102(b) as anticipated by Hartmann et al. (US 5425862). To anticipate, each element must be explicitly or implicitly taught by the reference and the limitations must be arranged and operate consistent with applicants' claims.

Claims 10 and 21 stand rejected under 35 USC §103(a) as obvious in view of Hartmann. Claims 6- 7 stand rejected under 35 USC §103(a) as obvious in view of Hartmann when read with Hirt et al. (US 4282073). Claims 13- 14 stand rejected under 35 USC §103(a) as obvious in view of Hartmann when read with Okinaka et al. (US 4469564). Lastly, claims 15- 16 stand rejected under 35 USC §103(a) as obvious in view of Hartmann when read with Avellone (US 4401523)

Hartmann is relied upon for the same limitations in the obviousness rejections of claims 6-7, 10, 15- 16 and 21 as it is relied upon for the anticipation rejection of claim 1.

III) The rejections of claims 1- 2, 5- 23 cannot be sustained for the following reasons.

Claim 1 stands rejected as being anticipated by Hartmann et al. in that Hartmann would disclose at least one electrolysis region and at least one contacting electrode being

disposed outside of the at least one electrolysis region, wherein the contacting electrode and the electrolysis region would be spaced apart from each other at a spacing which is such that small electrically conductive structures can electrolytically be treated. The Examiner takes this position because the contacting electrode and the electrolysis region of Hartmann would be deemed to be spaced close together since such terminology would be relative.

There is an important difference between the teaching of Hartmann and the present invention. Hartmann does not disclose that the spacing between the two contacting electrodes of one assembly does not exceed (is limited to) a few centimeters.

Hartmann discloses an apparatus for the electroplating of thin plastic films. Such thin plastic films have a conductive coating and are thus electrically conductive over the entire length of the film.

Hartmann does not disclose that the distance between the two contacting electrodes of one electrolysis region is in the range applicants have claimed. To the contrary, Hartmann clearly discloses that the distance between the two contacting electrodes is to be between 40 and 80 cm and preferably 50 cm (col. 9, lines 5-8).

Such distance is approximately ten times or more than the spacing between the two contacting electrodes of the device of the present invention.

It is for this reason that the device as claimed must be considered novel over Hartmann et al.

It is not obvious, to one of ordinary skill in the art, to select the spacing between the contacting electrodes in one electrolysis region, of only a few centimeters. One of ordinary skill would not be lead to the spacing of the present invention by the Hartmann reference. This is because Hartmann implicitly states that it would be considered unfavorable to reduce the spacing between the two contacting electrodes below his stated range of 40- 80 cm.

Referring to Hartmann at column 3, lines 15-21, the length of the Hartman chamber is limited by the risk of bending of the plastic film within the electroplating chamber such that the plastic film would touch one of the neighboring anodes. Now, in teaching away from reducing the length of the electroplating chambers and thus reducing the spacing between

the two contacting electrodes, Hartmann teachs providing a tampon of soft, open pored plastic foam inside the chamber on both sides between the plastic film and a stationary part. In so doing, Hartmann explicitly states that the "span", i.e., the length of the electroplating chamber which can be freely spanned by the plastic film, can thus be extended with the use of the tampon. See column 4, lines 10-15. This clearly shows that Hartmann suggests, to those skilled in the art, that the length of the electroplating chambers and thus the spacing between the two contacting electrodes should be as large as possible, thus clearly teaching away from the present invention.

If one skilled in the art would aim at electrolytically treating small electrically conductive structures on surfaces of work pieces, with the Hartmann apparatus he would not arrive at the solution of the present invention:

In addition, Hartmann teaches that spacing between neighboring bonding devices would be determined substantially by the inner voltage drop in the plastic film. Hartmann teaches that this spacing is between 40 and 80 cm. Assuming that small structures of 2-5 cm, like those addressed by the present the invention, would be treated in the Hartmann apparatus, these structures would be small compared to the Hartmann spacing (a few centimeters compared to a spacing of 40-80 cm between the bonding devices). Thus, many of such small structures (perhaps 10 to 20 structures) would be located (would fit) between the neighboring bonding devices. However, only the one structure at the inlet and the one structure at the outlet of the electroplating chamber would be contacted by a respective bonding device and will experience a voltage drop. The other structures located between these two bonding devices, will not be contacted by any of the bonding devices and will thus not experience a voltage drop.

In using a spacing of 40-80 cm in the Hartmann device, the voltage drop will not lead to non-uniform electroplating. One of ordinary skill would realize that the structures to be electroplated are a lot smaller compared to the Hartmann spacing, and therefore, would have no reason to suspect any problem with a too large a voltage drop. Consequently, one of ordinary skill would not change the Hartmann structure to minimize spacing.

Arguendo, if one skilled in the art would begin to gradually reduce the Hartmann spacing, starting from the minimum spacing of 40 cm, such person would immediately realize that this would not lead to any change in voltage drop in the contacted structures. Only the number of structures capable of being located between the contacted structures would be reduced as the spacing is reduced gradually. Therefore, through experimentation a one skilled in the art would not observe different results in voltage drop.

In the present invention, the small spacing between the contacting electrodes of a few centimeters confers an additional advantage in electrically treating small electrically conductive structures on surfaces of work pieces. Such additional benefit avoids a corrosive attack of copper surfaces being treated by the plating liquid, rather than avoiding a large voltage drop which is the focus of the Hartmann apparatus.

Due to the fact that in the present invention the small structures are permanently electrically contacted by at least one contacting electrode, the conductive structures are permanently kept on a negative potential. This negative potential counteracts the corrosive force of the electrolyte.

It should be noted that in electroplating, the electrolyte is normally exerting a corrosive action on the copper when it is in contact with the electrolyte without being in contact with the contacting electrode. For example, acid copper plating solutions comprise sulfuric acid which exerts this corrosive action. The structure, after having been contacted by the first one of the two contacting electrodes while being conveyed through the electroplating chamber, will be coated on the upstream edge of the structure, i.e., the edge which is contacted by the contacting electrode first, with a thicker copper layer than on the downstream edge, i.e., the trailing edge. This is due to the different contact times of the two edges with the electrolyte while being at the negative potential. Thus, the thickness of copper being deposited, especially on the downstream edge, is very low.

If the spacing between the contacting electrodes is as large as 40-80 cm, as taught by Hartmann, small structures which are as small as 5 cm for example, are not permanently contacted, i.e., the electrically conductive structures are not in constant electrical contact

with one of the contacting electrodes. Under such circumstances, etching of copper on the structures will take place and will cause detrimental destruction of the very thin copper layer especially at the downstream edge of the structures. Furthermore, due to the etching of the plated copper, the total amount of copper deposited is reduced and therefore the efficiency of the process is also reduced.

When the present invention is employed, the above disadvantages do not occur.

Therefore, one skilled in the art would have no reason to follow the teachings of Hartmann for electroplating structures in the size range addressed by the present invention with a spacing between contacting electrodes as taught by the present inventors.

IV) Okinaka is relied upon for showing a cat ion permeable membrane surrounding an anode. However, the Okinaka invention differs from the present invention in several ways.

(a) The membrane (24) does not touch the anode (counter electrode 22), i.e., it is not in contact with the anode.
(b) The membrane does not wipe any work piece lowered into the processing liquid bath.
(c) The membrane does not absorb the bath but is impermeable to the bath and its additives.
(d) The Okinaka cathode (25) is not positioned outside of the processing liquid bath, but is within the bath as is the counter electrode (22).
(e) The purpose and use of the Okinaka membrane (24) is to pass cat ions but to prohibit the organic additives in the processing liquid bath (i.e., the processing liquid bath outside of the membrane) from reaching the counter electrode (22).

From the above, one of ordinary skill in the art recognizes that the Okinaka membrane does not perform an electrical isolation function that applicant's isolation layer does, but a "filtering or barrier" function to eliminate a chemical reaction. In the Okinaka copper electroplating process, the undesirable oxidation, of certain components of the

copper electroplating bath, is prevented by the use of a membrane separating the anode from cathode. Hydrogen ions entering the cathode compartment (within the membrane) are neutralized by the addition of an alkaline agent (held within the membrane cathode compartment). See column 2, lines 21-33. The Okinaka membrane does not anticipate nor obviate applicant's isolation layer.

(V) Avellone is relied upon to show an electroplating apparatus for plating a metallic strip where the strip path is inclined to the horizontal. See Figs. 7 and 7A. Also see, column 10 lines 40- 45, and lines 63- 65, column 11 lines 1- 5 and 14- 27. While Avellone does show both his plating anodes and his strip path to be inclined, his structure deviates from applicants in that the inclination is not continuous from the entrance to exit of each plating unit 200, 202, 204 (Figs. 7 and 7A). Avellone's processing baths are not in closed units as with applicant's invention. Thus Avellone uses deflection rollers within each of his plating units 200, 202, 204 (Fig. 7A) to bring his strip path back to horizontal before exiting a plating unit. Thus, Avellone does not anticipate nor obviate a continuous incline of a strip path from the entrance to the exit of a plating unit.

VI) New claims 36- 51 have been added which recite limitations neither anticipated nor obviated by the cited prior art.

VII) It is requested that the application be examined with respect to amended claims 1-2 and 5- 23, and new claims 35- 51.

The withdrawn claims are 17 in number. The new claims are 17 in number. No additional fees are believed to be required. In the event that an additional fee is required with respect to this communication, the Commissioner is hereby authorized to charge any additional fees, or credit any overpayment, to Paul & Paul Deposit Account No. 16-0750. (order no. 7594)

Respectfully submitted,
Paul & Paul

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